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EMPLOYMENT OF WASTE FOR IRRIGATION PURPOSES

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Abstract: -

This paper deals with Irrigation using treated agricultural or food processing industry as wastewater can allow more intensive use of the land, improve plant vigour and may extend growing seasons. Nutrients in wastewater (as organic carbon, nitrogen, phosphorus and potassium) can be balanced to plant growth needs, or natural waters can have had nutrients added. This form of irrigation is called fertigation. Irrigation with chemical addition to vegetation needs an effective environmental management plan (EMP) to prevent harm to the environment. Our aim in this paper is to give ways that ensure that resources are used efficiently, that land is not degraded or waterlogged and that natural waters are protected from salinity, turbidity, nutrient-enrichment, leached trace metals, pesticides and other harmful wastewater contaminants.

Keywords: - *fertigation, waste water, irrigation, risks, policies.*

INTRODUCTION

Irrigation with polluted water or wastewater is a widespread reality, especially in low-income countries where it is popularly used for vegetable cultivation. Yet many policymakers are unaware of the significance of the practice and the benefits it can bring. Nor do they know that practical recommendations are now available to make wastewater use safer and more sustainable without relying on non-affordable treatment technologies alone.Nutrients in wastewater (as organic carbon, nitrogen, phosphorus and potassium) can be balanced to plant growth needs, or natural waters can have had nutrients added. This form of irrigation is called fertigation.This paper covers the controlled sprinkler, dripper or sub-surface irrigation of vegetated land with stabilised, nutrient-rich wastewater from:

*Industry, such as abattoirs, animal holding yards, aquaculture, breweries and food processors
*Recycled run-off from agricultural and tree plantation land.

The primary aims of fertigation are to use water resources efficiently, stimulate growth of healthy vegetation (e.g., trees, crops, gardens and turf), limit the need for chemical supplements and minimize the risk of harm to water resources. Fustigation of poorly vegetated or bare land and native vegetation acclimatized to natural rainfall patterns and low nutrient uptake is not recommended, as it fosters erosion and may harm plants accustomed to a low nutrient environment.

Advantages Of Using Wastewater In Irrigation

- It permits higher crop yields, year-round production, and enlarges the range of crops that can be Irrigated, particularly in (but not limited to) arid and semi-arid areas.
- Recycles organic matter and other nutrients to soils.
- It therefore reduces the cost of fertilizers (or simply makes them more accessible to poor farmers).
- Reduces the use of synthetic fertilizer.
- Acts as a low-cost wastewater disposal method that can also be hygienic (under controlled Conditions).
- Avoids discharging pollutants to surface water bodies (which have a considerably lower treatment Capability than soils).
- Increases the economic efficiency of investments in wastewater disposal and irrigation.
- Conserves freshwater sources and reduces negative impacts on surface water bodies.
- Can recharge aquifers through infiltration.
- Improves soil properties (soil fertility and texture).
- The cost of pumping wastewater from nearby channels is lower than the cost of pumping Groundwater.
- It offers additional benefits such as greater income generation from cultivation and marketing of High-value crops, which contribute to improved nutrition and better education opportunities for Children.

Risks And Drawbacks

- To maximize the benefits and minimize drawbacks, wastewater reuse must be carefully planned.
- Because the impact of pollution is generally less and takes longer in soils (and aquifers) than in Surface water, some governments may delay the construction of necessary wastewater treatment Facilities.
- Water salinity and metal content in soils is increased in the long term.
- Storage capacity is needed to adapt/reconcile continuous wastewater production with crops' water Demand and water supplied by precipitation.
- Under non-controlled conditions (a) pathogens contained in wastewater can cause health problems For humans and cattle; (b) some substances that may be present in wastewater can be toxic to plants, Cattle, or humans consuming crops; (c) some substances that may be present in wastewater can Reduce soil productivity; and (d) infiltration of wastewater to aquifers may cause aquifer pollution With pathogens and organic matter.

Effects On Biosphere

Surprisingly, the health effects of irrigating with wastewater can be both positive and negative. The Positive effects have not been fully studied, but they have begun to be recognized in literature and are Related to food security in poor areas. Thanks to wastewater, it is possible (and commonly the only way) To produce food and increase income in poor areas, thus also increasing nutrition and the quality of life. Malnutrition plays a significant role in the death of 50 percent of all children in developing countries (10.4 million Children under the age of five die annually from it, according to Rice et al. [2000]).

Besides adding nutrients, irrigating with wastewater enriches the humid content by supplying organic Matter, which increases soil humidity, retains metals (through cationic exchange and the formation of organ-metallic compounds), and enhances microbial activity (Ortega-Larose et al. 2002). If organic Matter content in wastewater is less than 350–500 mg/L, all these effects enhance soil productivity by Avoiding soil clogging. Recycling nitrogen, phosphorus, potassium, and organic matter to soil is Important because it closes their ecological cycles instead of interrupting them, as is traditionally done When these compounds are removed from wastewater, trapped into sludge, and dumped with it in Confinement sites or landfills. But in the case of phosphorus, recycling is even more important because Its reserves are limited and dwindling; recycling it is even being promoted by the phosphate industry (CEEP 2001).

Irrigating with wastewater also has negative effects on soils. The most common one reported is an Increase in metal

content that, depending on the level, may or may not be harmful. The use of domestic Wastewater (treated or not) to irrigate results in the accumulation of metals in upper layers of soil with No negative effects on crops, even when applied over long periods of time (several decades). However, Wastewaters containing industrial effluents with high metal contents not only accumulate metals but also Cause damage to crops and eventually to consumers. Regardless of the wastewater metal content, for Metal uptake by crops a certain level has to be reached in soils but also be present in the mobile fraction. Metals are fixed to soils with a pH of 6.5–8.5 and/or with high organic matter content. Fortunately, Sewage pH is always slightly alkaline (7.2–7.6). This value, combined with an important soil and Wastewater alkalinity maintains original soil ph. The elements of major concern are cadmium, copper, Molybdenum, nickel, and zinc. In some cases, the presence or absence of other divalent metals in the Soil can influence the uptake of heavy metals.

Waste water management practices

To maximize the benefits and reduce the drawbacks of wastewater irrigation, several management Practices must be put in place, the combination of which should offer an optimum solution for a given Set of local conditions. The use of an integral management approach has several advantages, because, Besides being a more reliable multi-barrier system, it permits flexibility and the selection of lower and More socially and economically acceptable control measures to protect health and the environment While fostering food security. The management practices discussed below can be used in several Combinations.

a. Segregation, pretreatment, and reduction of noxious compounds in domestic wastewater. Pollutants such as heavy metals, toxic organic compounds, and salts coming mainly from industrial Discharges are difficult to remove from wastewater, and so it is cheaper, easier, and safer to prevent

Them from being discharged into the sewage system in the first place. Beside this, it is also Important to promote cleaner industrial production processes in order to avoid the use and discharge of toxic compounds, as well as to educate society to reduce the use of toxic compounds at home and their unsafe disposal.

b. Wastewater treatment. Whenever possible, wastewater treatment is needed to reduce pollutants. In that respect, organic matter and nutrients are not targeted compounds for agricultural purposes, especially if soils are poor, while pathogens are of the most importance. This need implies different Treatment technologies than those conventionally used to protect water bodies. Fortunately, in a Number of cases, this option can be implemented at a reduced cost that is affordable to developing Countries (Pasco 1992; Mara 2003; Jiménez and Gardena 2001). A particular need that has to be Considered in developing countries for wastewater treatment selection is the efficiency and Reliability of a process for removing helminthes ova (Jiménez 2005b).

c. Water management. When there is the possibility of using additional sources of water, an option For partially controlling the negative impacts caused by wastewater is to blend it with freshwater, or To use them in an alternative way by preferring freshwater close to the harvesting period.

d. Wastewater storage. As mentioned above, storing wastewater as part of the irrigation system Improves its quality by reducing the content of pathogens and pollutants associated with suspended Solids. For this reason, maximizing storage time is important when designing wastewater irrigation Systems.

e. Aquifer protection. To avoid negative effects stemming from the infiltration of wastewater, it is Recommended to do the following: (a) recognize its occurrence and quantify the phenomenon; (b) Before reusing water, establish cost-effective patterns of rational water use and management; (c) Improve agricultural irrigation practices; (d) establish criteria to drill wells used to supply water for Human consumption in the surroundings (i.e., distances to irrigation sites, depth of extraction, and Appropriate construction); (e) promote water reuse for agriculture, preferably in zones where Aquifers are less vulnerable; and (f) undertake constant and efficient monitoring of underground Water (Foster et al. 2004).

f. Agriculture management:

- **Crop selection and restrictions.** Crops are enormously varied in nature and behavior; Therefore, an appropriate selection can reduce the different risks generated by the use of Wastewater. Crops can be selected to overcome salinity and toxicity due to chlorides, sodium, and boron, and reduce health hazards for consumers (FAO and UNESCO 1973). The crops that Are of major health concern are those that are eaten raw by humans or animals. Irrigation of Landscape plants, industrial crops, and afforestation for commercial purposes (fruit, timber, fuel, and charcoal) or environmental protection display a much lower risk, mainly due to limited Human contact. In order to be effectively implemented by farmers, crop selection needs to Consider economic benefits. For instance, flowers can be selected as crops because they carry a Low health risk and a high economic value.

- **Site restrictions.** Wastewater's negative impact can also be controlled by limiting the sites Where it is applied. Normally, water areas with restricted access to public, far from potable Water sources, or where the aquifer is at a sufficient depth (less than 3 meters) should be Preferred. Also, irrigation areas can be limited to fields where it is possible to have buffer areas Around them or where soils have a significant depollution capacity. Wastewater irrigation of Pasturing sites should be avoided.

• **Irrigation methods.** Besides the normal factors considered when selecting an irrigation Method when using wastewater (i.e., water availability, climate, soil, crops to be grown, cost of Irrigation method, and the ability of the farmer to manage the system), other considerations Need to be taken into account, such as possible contamination of plants and harvested product, Health threats to farm workers, environmental impacts, salinity, and toxicity hazards. Basin or Flood irrigation involves complete coverage of the soil surface and will contaminate vegetables Growing near to the ground as well as root crops. Besides not being an efficient method of Irrigation, it also exposes farm workers to the effluent more than any other method. Furrow Irrigation does not wet the entire soil surface, thus limiting crop contamination. If the effluent Is transported through pipes and delivered into individual furrows by means of gated pipes, then risk to irrigation workers will be reduced. Sprinkler irrigation contaminates ground crops, Fruit trees, and farm workers, and it can provoke severe leaf damage if water contains chlorides or bicarbonates, resulting in significant yield losses. Trickle and drip irrigation, particularly When the soil surface is covered with plastic sheeting or other mulch, uses effluent more Efficiently and can often produce higher crop yields; it certainly provides the greatest degree of Health protection for farm workers and consumers (Pasco 1992).

• **Control of soil salinization.** Normally, wastewaters are not very saline (200–500 mg/L or 0.7–3.0 ds/m). On specific occasions (i.e., saline soils areas, saline discharges to sewers, or sea Intrusion to water supplies that generates sewage), however, salinity concentration exceeds the 2,000 mg/L level. In these cases, appropriate water management practices need to be followed To prevent soil salinization through leaching and drainage. Several recommendations are Documented but are beyond the scope of this paper.

• **Crop management practices valid under saline water use will be valid under wastewater Use.** These practices are aimed at preventing damage to crops caused by salt accumulation Surrounding the seeds. This is achieved by planting on the shoulder of the ridge, using sloping Beds with seeds planted on the sloping side but above the water line, and irrigating alternate Rows so that the salts can be moved beyond the single seed row.

• **Land soil management is important.** Done properly it makes irrigation with wastewater Easier, reduces salinity problems, and increases irrigation efficiency. Typical activities include Leveling of land to a given grade, establishing adequate drainage (both open and sub-surface Systems), and deep plowing and leaching to reduce soil salinity.

• **Irrigation timing.** Proper timing of irrigation is important to ensure removal of nitrogen Through nitrification/DE nitrification when there are eutrophication risks to lakes or reservoirs Posed by the discharge of the drainage water. Also, to reduce transportation of pesticides, Irrigation must not be performed just after their application to fields.

• **Irrigation rates.** Gauging of irrigation rates should be done in such a way that water demand by crops is satisfied but the infiltration of low-quality wastewater to the subsoil is avoided.

g. Education and participation. When using wastewater (even treated), it is important to inform the Population of the associated risks, the water quality, and measures that can be used to reduce or control such risks. To that end, planned education and information campaigns need to be conducted on an ongoing basis. In particular, the proper agricultural practices, the use of protective clothing, and how to properly wash and disinfect vegetables and fruits grown in wastewater should be Addressed. While using wastewater that has been treated to a high level will diminish the need for public participation and education, it is nevertheless very costly.

h. Health campaigns. The health sector should undertake ongoing campaigns to monitor the effects on public health and subsequently supply farmers and their families with anthelmintic drugs.

Conclusion

Given agriculture's high demand for water, as well as an increase in the urban population that Demands food and produces wastewater, agricultural water reuse is bound to grow. In developing Countries there are several examples of the use of wastewater to irrigate and, as long as wastewater Production increases along with demand for food, the governments of such countries will increasingly Have to adopt planned approaches rather than unplanned ones. Governments need to take control of the Situation in order to progressively but constantly put in place management measures to protect health and the environment, while also giving a productive use to wastewater.

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